

CLAIMS

103 1/ (1) A pinion<sup>12</sup> moveable along a output shaft<sup>14</sup> of a starter assembly<sup>10</sup>, the pinion<sup>12</sup> having an inner surface<sup>32</sup> disposed about the output shaft<sup>14</sup>, the inner surface<sup>32</sup> extending to an end face<sup>50</sup> of the pinion<sup>12</sup>, the pinion comprising:

a primary edge<sup>52</sup> for moving particles from the shaft<sup>14</sup> as the pinion<sup>12</sup> moves along the output shaft<sup>14</sup>, the primary edge<sup>52</sup> being formed along a length of the inner surface<sup>32</sup> and extending to the end face<sup>50</sup>, the primary edge<sup>52</sup> defining a groove<sup>54</sup> in which the particles are received as the pinion<sup>12</sup> moves along the output shaft<sup>14</sup>, the groove<sup>54</sup> being formed along the length of the inner surface<sup>32</sup> and adjacent a primary edge<sup>52</sup>.

103 (2) The starter pinion of claim 1 wherein the pinion<sup>12</sup> is a one-piece pinion.

(3) The starter pinion of claim 1 wherein the pinion<sup>12</sup> is rotatably and linearly moveable along the output shaft<sup>14</sup>.

(4) The starter pinion of claim 1 wherein the output shaft<sup>14</sup> is rotatable.

(5) The starter pinion of claim 1 further comprising a secondary edge<sup>56</sup> for moving the particles from the primary edge<sup>52</sup>, the secondary edge<sup>56</sup> being radially formed on the end face<sup>50</sup> adjacent the primary edge<sup>52</sup>.

(6) The starter pinion of claim 1 wherein the primary edge<sup>52</sup> moves particles from a portion on the output shaft<sup>14</sup> as the pinion<sup>12</sup> moves along the output shaft<sup>14</sup>.

7. The starter pinion of claim 1 wherein the primary edge is arcuately formed along the inner surface of the pinion.

NE 8. The starter pinion of claim 1 wherein the primary edge is formed essentially linear on the inner surface of the pinion.

9. The starter pinion of claim 1 wherein the inner surface has a plurality of primary edges formed thereon.

10. The starter pinion of claim 9 wherein the inner surface includes a plurality of grooves, each groove being formed along the length of the inner surface and adjacent each respective primary edge.

11. The starter pinion of claim 1 wherein the length along which the primary edge is formed includes the entire length of the inner surface.

12. The starter pinion of claim 1 wherein the length along which the primary edge is formed includes a portion of the length of the inner surface.

13. The starter pinion of claim 1 wherein the starter pinion is made of a metal.  
(at least partially) (ol 2 lines 6-7)

14. The starter pinion of claim 1 wherein the pinion includes a barrel portion and a gear portion, the end face and the inner surface being adjacent the gear portion.

15. A starter pinion moveable along an output shaft of a starter assembly, the pinion comprising:

an inner surface having a bore formed therethrough, the inner surface being disposed about the output shaft and extending to an end face of the pinion; and

a groove for receiving and moving particles along the output shaft as the pinion moves along the output shaft, the groove being formed along a length of the inner surface and extending to the end face, the groove defining a primary cleaning edge formed adjacent the groove along the length of the inner surface.

16. The starter pinion of claim 15 further comprising a secondary edge for moving the particles from the primary edge, the secondary edge being radially formed on the end face adjacent the primary edge.

17. The starter pinion of claim 15 wherein the groove is arcuately formed along the inner surface of the pinion to receive and move particles from a portion on the output shaft as the pinion moves therealong.

NE 18. The starter pinion of claim 15 wherein the groove is formed essentially linear on the inner surface of the pinion to receive and move particles from a portion on the output shaft as the pinion moves therealong.

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19. ✓ The starter pinion of claim 15 wherein the inner surface has a plurality<sup>32</sup> of grooves<sup>54</sup> formed thereon.

20. ✓ The starter pinion of claim 15 wherein each groove<sup>54</sup> is formed along the length of the inner surface<sup>32</sup> and adjacent each primary edge<sup>52</sup>.

21. ✓ The starter pinion of claim 15 wherein the length along which the groove<sup>54</sup> is formed includes the entire length of the inner surface<sup>32</sup>.

NE 22. A starter assembly for startup of an engine, the assembly comprising:  
a starter motor to provide power to the starter assembly;  
an output shaft rotatably attached to the motor and powered thereby to rotate the shaft, the shaft having an external helical spline formed thereabout;  
a starter pinion being moveable along the output shaft, the pinion having a teeth portion on which teeth are formed about an outer surface of the pinion and a race portion attached to the teeth portion, the teeth portion having a bore formed therethrough defining an inner surface of the teeth portion, the inner surface being disposed about the output shaft, the inner surface extending to an end face of the pinion, the inner surface having a groove for receiving and removing particles along the output shaft when the pinion moves therealong, the groove being formed along a length of the inner surface to the end face defining a primary cleaning edge formed adjacent the groove along the length of the inner surface;

a barrel having a pinion-receiving end and a collar-receiving end, the pinion-receiving end connecting to the race portion of the pinion, the collar-receiving end oppositely extending from the barrel and including an inside surface having a internal helical spline formed thereon, the internal helical spline complementing the external helical spline and engaged therewith, the barrel including a collar disposed about the collar-receiving end and having a mounting member; and

a solenoid switch including a connecting rod and a shifting lever having first and second ends, the first end attaching to the connecting rod, the second end attaching to the mounting member, the solenoid switch being configured to power the starter motor during engine startup after pulling the end of the shifting lever toward the solenoid switch and moving the pinion along the shaft.

NE 23. The starter pinion of claim 22 further comprising a secondary edge for moving the particles from the primary edge, the secondary edge being radially formed on the end face adjacent the primary edge.

NE 24. The starter pinion of claim 22 wherein the groove is arcuately formed along the inner surface of the pinion to receive and move particles from a portion on the output shaft as the pinion moves therealong.

NE 25. The starter pinion of claim 22 wherein the groove is formed essentially linear on the inner surface of the pinion to receive and move particles from a portion on the output shaft as the pinion moves therealong.

NE 26. The starter pinion of claim 22 wherein the inner surface has a plurality of grooves formed thereon.

" 27. The starter pinion of claim 22 wherein each groove is formed along the length of the inner surface and adjacent each primary edge.

" 28. The starter pinion of claim 22 wherein the length along which the groove is formed includes the entire length of the inner surface.

11 29. A method of moving particles from an output shaft with a starter pinion of a drive assembly, the pinion having an inner surface disposed about the output shaft and an end face, the method comprising:

providing a primary edge and groove formed on the inner surface for moving particles from the output shaft as the pinion moves along the output shaft, the primary edge and the groove being formed along a length of the inner surface of the pinion and extending to the end face;

moving the pinion in a first direction along the output shaft;

moving the particles in the first direction for a predetermined distance as the pinion moves along the output shaft;

moving the pinion in a second direction opposite the first direction along the output shaft; and

releasing contact of the particles.

" 30. The method of claim 29 further comprising:

contacting the particles with the primary edge as the pinion moves along the output shaft in the first direction; and

receiving the particles in the groove as the pinion moves in the first direction.

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31. The method of claim 29 further comprising:

providing a secondary edge for secondarily moving the particles away from the primary edge upon a subsequent engine start-up, the secondary edge being radially formed on the end face adjacent the primary edge.

" 32. The method of claim 31 further comprising:

contacting the particles with the secondary edge upon a subsequent engine start-up; and

moving the particles with the secondary edge further along the shaft to the predetermined distance as the pinion moves in the first direction.

" 33. The method of claim 29 wherein the particles are rotationally and linearly moved in the first direction.